TROUT POPULATIONS IN SIDNEY CREEK, MARINETTE COUNTY, WISCONSIN

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ABSTRACT

A study was conducted to gain some insight into the population dynamics of brook and brown trout in a northeastern Wisconsin stream. Petersen mark and recapture estimates were made on the trout population of Sidney Creek, Marinette County, during the spring, summer, and fall from 1969 through 1972.

Standing crops of trout averaged 46 lbs/acre for the study period; however, this figure fluctuated a great deal seasonally. Most of the variation was attributed to movement of brown trout into and out of the study areas. The brook trout population was relatively stable. Growth of trout was slower than in similar-sized streams in southern Wisconsin. Trout in the upper reaches of Sidney Creek had slower growth than those in the lower reaches.

INTRODUCTION

Sidney Creek is a small spring-fed tributary to the North Branch of the Pike River located in the northwestern part of Marinette County, Wisconsin. This stream, along with the Macintire Creek, empties into North Pond, a headwaters impoundment on the North Branch of the Pike. The Sidney is a little over 7 miles in length and has an average width of 16 feet. It supports an excellent naturally-reproducing population of brook and brown trout.

Beginning in 1969, the trout populations of Sidney Creek were studied in conjunction with an inventory of the Pike River watershed. Very little work had been done prior to this time on the population dynamics of trout in this area, an area that has the highest concentration of trout streams in the state. The major objectives of the study were to gain some basic knowledge of the standing crops and growth of stream trout in northeastern Wisconsin. A complete inventory of Sidney Creek was conducted during 1969 and 70; results of that survey can be found elsewhere (Thuemler, 1971).

STUDY AREA

Sidney Creek is fed by an excellent groundwater supply throughout most of its length and water temperatures remain well within the tolerance limits of trout. Sand is the predominant bottom type in the lower reaches of the stream; however, gravel, rubble, and boulders are prevalent in the upper portions. The combination of a fine gravel substrate and abundant groundwater input provides good trout spawning areas, especially in the upper portion of the stream. The stream has a base flow of approximately 15 cfs and is relatively stable throughout the year with no great fluctuations in water levels.

Two study areas were set up on Sidney Creek in the fall of 1969 (Fig. 1 and Table 1). The lower, or downstream, station is 1,950 feet long and has an average width of 23 feet and an average depth of 0.9 feet. The station starts just upstream from North Pond and is in an area of shrub marsh. The stream has a very low gradient at this point as witnessed by the bottom substrate which is 85 percent sand with the rest being silt and detritus. Good instream cover is provided by undercut banks and deep pools. The land fronting this lower station is owned by a private fishing club and is not open to the public. The club members themselves do very little fishing on this piece of water. Spawning areas are limited.

The upper station is 850 feet long and has an average width of 17 feet and depth of 0.7 feet. It is located in an area of slightly higher gradient, but still has a predominantly sand bottom type, although 20 percent of the substrate is gravel and 5 percent rubble. Good spawning areas are present throughout. There is more of a canopy over the stream in this station, as the bank vegetation changes to swamp hardwoods and conifers. Instream cover, especially for larger trout, is limited, as there are very few deep pools or undercut banks and the main cover is

Table 1. Characteristics of study areas on Sidney Creek

Stream Characteristic	Lower Station	Upper Station
Length	1950 feet	850 feet
Average Width	23 feet	17 feet
Average Depth	0.9 feet	0.7 feet
Bottom Substrate	85% sand, 10% silt, 5% detritus	5% silt, 5% rubble, 70% sand, 20% gravel
Spawning Areas	limited	abundant
Bank Cover	10% swamp conifer 90% shrub marsh	50% swamp hardwood 40% swamp conifer 10% shrub marsh
Stream Cover	open	dense to partly open
Instream Cover	pools, undercut banks, trees	logs, trees, rocks, boulders
Pool Grade	50% > 3'	less than 6"
Pool-Riffle Ratio	100:0	75:25
Total Alkalinity (M.P.A.)	111 mg/1	100 mg/1
Conductance @ 77°F	250 mmhos/cm	238 mmhos/cm·
рН	7.0	7.2

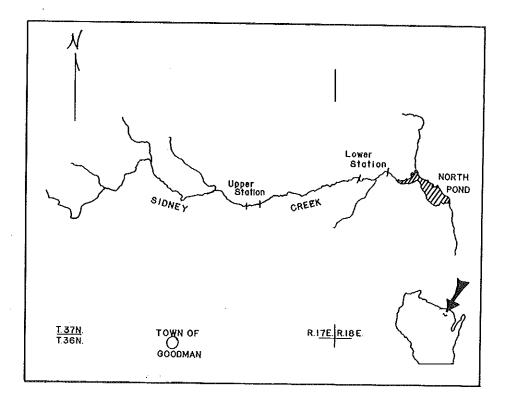


Figure 1. Map showing location of Sidney Creek and the study area.

provided by rocks, boulders, fallen trees, and root tangles. Stream frontage along this station is in private forest crop land and is open to public fishing; however, it does not receive much pressure.

METHODS

Electrofishing gear was used to obtain information on trout populations. A 250 volt D.C. stream shocker using two electrodes (Novotny & Priegel, 1971) was used throughout the study. Petersen mark and recapture estimates by one-half-inch groupings were made at both the upper and lower stations each spring, summer, and fall beginning in the fall of 1969 and running through the summer of 1972. Trout were measured to the nearest 0.1-inch and weighed to the nearest gram. Age 0 trout were fin-clipped each fall and the following spring. Each year class was given a distinctive clip. There was no size overlap between Age 0 and I trout in the fall and very little in the spring.

All population estimates were made using the Bailey modification of the Petersen formula (Ricker, 1958):

Confidence intervals were calculated on each half-inch grouping using the following formula (Ricker, 1958):

$$V(N) = \frac{\Lambda^{2}(C-R)}{(C+1)(R+2)}$$

Limits of 95% confidence =
$$\stackrel{\wedge}{N} \pm 2\sqrt{V(\stackrel{\wedge}{N})}$$

Spring estimates were generally made right before the trout fishing season opened in the middle of May. The summer estimates were made around the beginning of July and fall estimates in mid-September to correlate with the end of the trout season on September 15.

RESULTS

Standing Crops: Intrastation Comparisons

Upper Station. The total biomass of trout in the upper station varied between 20.9 lbs/acre and 79.1 lbs/acre during the study period (Table 2). The average biomass was 48.5 lbs/acre, made up of 34.3 lbs of brown trout and 14.2 lbs of brook trout. The biomass was consistently lower in the spring, averaging 27.5 lbs/acre, versus the summer, (48.4 lbs/acre), or fall (69.5 lbs/acre). Most of the difference was due to changes in the brown trout population. The Age 0 (fingerling) trout were only included in the fall estimates and made up about 20% of the total biomass.

Table 2. Standing crops of trout in upper Sidney Creek station.

**************************************	Pounds	of trout per	acre
Date	Brown	Brook	Total
Fall 1969*	61.5	10.9	72.4
	(8.8)	(2.8)	(11.6)
Spring 1970	16.3	11.3	27.6
Summer 1970	35.5	13.3	48.8
Fall 1970*	61.2	17.9	79.1
	(8.6)	(2.9)	(11.5)
Spring 1971	20.2	13.9	34.1
Summer 1971	27.4	7.2	34.6
Fall 1971*	41.6	15.5	57.1
	(14.8)	(2.9)	(17.7)
Spring 1972	12.1	8.8	20.9
Summer 1972	32.7	29.1	61.8
Average Overall	34.3	14.2	48.5
Average Spring	16.2	11.3	27.5
Average Summer	31.9	16.5	48.4
Average Fall	54.8	14.7	69.5

^{*}Fall estimates were the only ones to include Age 0 trout - biomass in parentheses.

Table 3. Number of trout per acre in upper Sidney Creek station (95% confidence limit follows estimate)

Date of Estimate	Brown Trout	Brown Trout	Total
		40	
Fall 1969*	2179 <u>+</u> 524	621 <u>+</u> 291	2800 ± 815
Spring 1970	806 + 497	542 + 421	1348 + 918
Summer 1970	806 🕂 327	315 + 200	1121 ± 527
Fall 1970*	1830 + 333	633 7 255	2463 + 588
Spring 1971	1000 + 242	536 + 333	1536 ∓ 575
Summer 1971	758 - 391	425 + 170	1183 + 561
Fall 1971*	2733 + 576	648 + 267	3381 + 842
Spring 1972	879 T 282	379 + 227	1258 + 509
Summer 1972	939 🛨 318	506 + 242	1445 7 561
Average	1325	512	1837

^{*}Fall estimates are only ones to include fingerling (Age 0) trout.

The total number of trout per acre in the upper station varied between 3,381 and 1,121 and averaged 1,837 (Table 3). This average was made up of 1,325 brown trout and 512 brook trout. The number was highest in the fall, when Age 0 fish made up 65% of the population. The spring and summer estimates were similar, averaging 1,381 and 1,250 trout/acre respectively. During these estimates, however, browns outnumbered brooks by almost 4:1. On an average, only 8% of the total trout population was of legal size in the upper station (Fig. 2 and 3).

Lower Station. The total biomass of trout in the lower station varied between 73.7 lbs/acre in the fall of 1969 and 11.2 lbs/acre in the spring of 1972 (Table 4). The average biomass was 43.6 lbs/acre made up of 28.6 lbs of brown trout and 15.0 lbs of brooks. The biomass was consistently lower in the spring, averaging 21.8 lbs/acre, versus the summer (49.3 lbs/acres) or fall (59.4 lbs/acre). As in the upper station, most of this difference can be attributed to the brown trout population as the brooks stayed relatively constant throughout the year. The Age 0 (fingerling) trout were included in the fall estimates only and made up about 7% of the total biomass.

The total number of trout per acre in the lower station varied between 1,130 and 255 and averaged 611 (Table 5). This average was made up of 323 brown trout and 288 brooks. The numbers were highest in the fall when Age 0 fish made up 41% of the population. The brown trout population fluctuated much more than the brook trout population. The brook to brown ratio in the lower station was about 53% browns to 47% brooks. About 43% of the average population was of legal size in the lower station (Fig. 4 and 5).

Standing Crops: Interstation Comparisons

The average standing crops in the upper and lower stations were similar, being 48.5 and 43.6 lbs/acre respectively. However, there were about 2 lbs of brown trout for every pound of brook trout in both stations. Also, trout in the upper station were generally smaller fish, as indicated by the fact that there were three times as many trout in the upper station than in the lower station. This relationship is shown in a length-frequency distribution of the trout captured in the summer of 1972, which is representative of most of the other estimates (Fig. 6). Of the total number of trout in that estimate (not including fingerlings) 44% were of legal size (6 inches) in the lower station and only 10% had attained this size in the upper station.

The total biomass was the lowest in both stations during the spring estimates and this was mainly due to a decreased poundage of brown trout. The brook trout population stayed fairly constant throughout the year in both stations. There was a greater seasonal fluctuation in the brown trout population in the lower station than in the upper station.

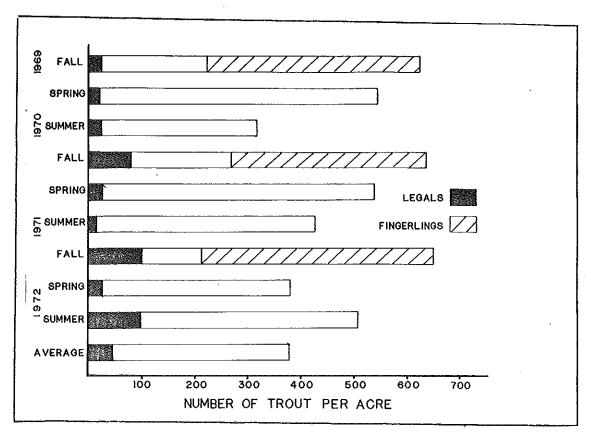


Figure 2. Estimated number of brook trout present in the upper Sidney Creek station.

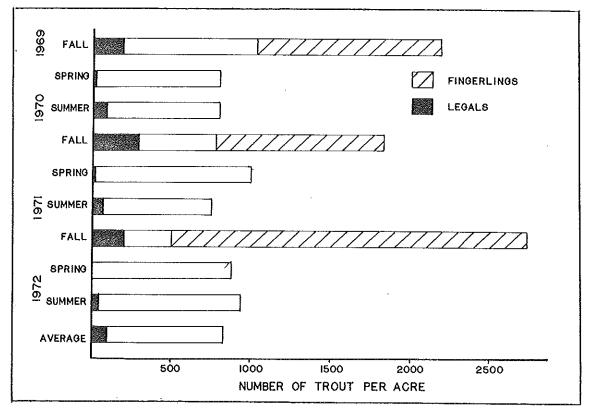


Figure 3. Estimated number of brown trout present in the upper Sidney Creek station.

Table 4. Standing crops of trout in the lower Sidney Creek station.

	Por	unds of Trout p	er Acre
Date	Brown	Brook	Total_
Fa11 1969*	54.5	19.2	73.7
	(2.3)	(2.5)	(4.8)
Spring 1970	12.3	27.6	39.9
Summer 1970	48.2	12.0	60.0
Fall 1970*	35.2	14.4	49.6
	(2.6)	(1.0)	(3.6)
Spring 1971	2.2	12.2	14.4
Summer 1971	38.7	10.7	49.4
Fall 1971*	39.1	15.8	54.9
	(1.3)	(3.5)	(4.8)
Spring 1972	2.4	8.7	11.2
Summer 1972	24.8	14.0	38.2
Average Overall	28.6	15.0	43.6
Average Spring	5.6	16.2	21.8
Average Summer	37.2	12.2	49.3
Average Fall	42.9	16.5	59.4

^{*}Fall estimates were the only ones to include Age 0 trout - biomass in parentheses.

Table 5. Number of trout per acre in the lower Sidney Creek station. (95% confidence limit follows estimate)

Date of Estimate	Brown trout	Brook trout	Total
Fall 1969*	637 + 274	496 + 330	1130 + 604
Spring 1970	248 + 167	424 + 280	672 + 447
Summer 1970	385 + 183	236 + 117	621 + 300
Fall 1970*	445 十 147	264 ± 148	709 ± 295
Spring 1971	71 + 60	184 ± 154	255 ± 215
Summer 1971	344 ± 83	106 <u>+</u> 43	450 <u>+</u> 125
Fall 1971*	451 <u>+</u> 194	490 <u>+</u> 391	941 <u>+</u> 585
Spring 1972	72 <u>+</u> 38	210 + 79	282 + 117
Summer 1972	251 <u>+</u> 99	178 ± 37	428 ± 136
Average	323	288	610

^{*}Fall estimates are only ones to include fingerling (Age 0) trout.

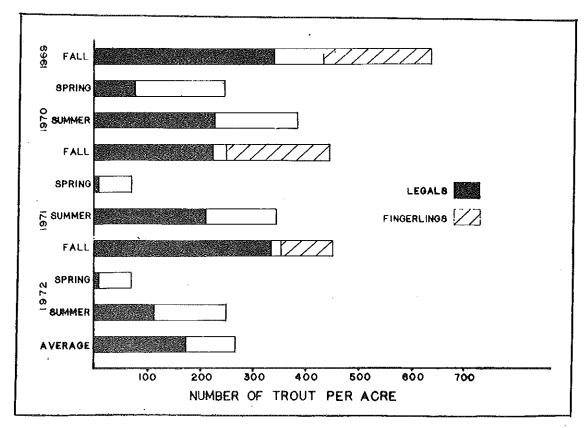


Figure 4. Estimated number of brook trout present in the lower Sidney Creek station.

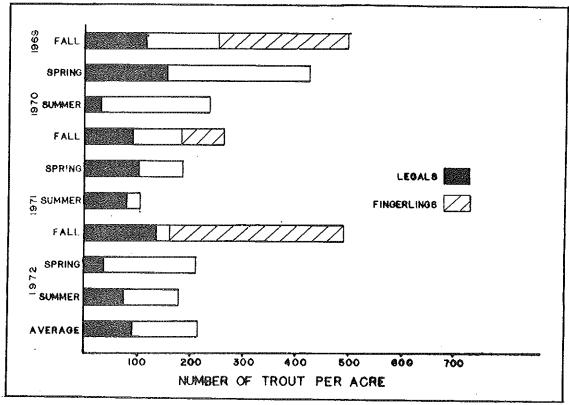


Figure 5. Estimated number of brown trout present in the lower Sidney Creek station.

Natural Reproduction

There was a much larger population of Age 0 (fingerling) trout in the upper station (average 1,884 per acre) than in the lower station (average 383 per acre). Fingerling brown trout outnumbered brooks by more than 3 to 1 in the upper station, whereas fingerling brook trout outnumbered browns 218 to 165 in the lower station (Fig. 7).

Growth Rates

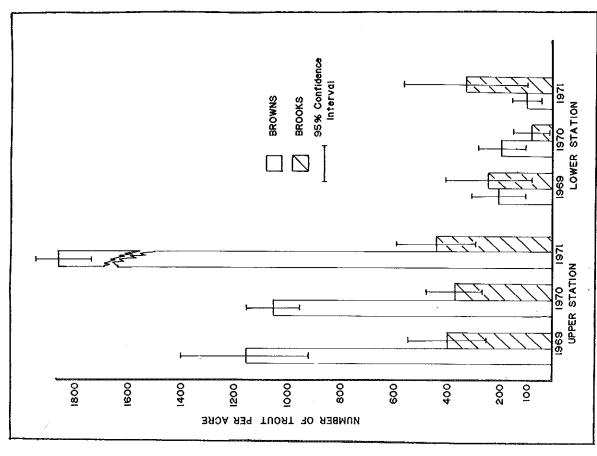
Growth rates of Sidney Creek trout are shown in Table 6. These rates are all based on known-age fish which were permanently marked as fingerlings. The average trout in the lower station reached legal size by the end of its second summer in the stream (Age I), whereas those in the upper station did not reach that size until their third summer (Age II).

DISCUSSION

The standing crop of trout in the Sidney Creek averaged 46 lbs/acre over the study period. This figure fluctuated greatly, depending on the station sampled and the time of the year. For example, in the fall of 1969 the brown trout biomass in the lower station was 54.5 lbs/acre, in the spring of 1970 it had dropped to 12.3 lbs/acre, and two months later it was up to 48.2 lbs/acre. The brown trout biomass in the upper station during that same time span fluctuated between 61.5 lbs/acre and 16.3 lbs/acre. These large changes are probably due to a movement of the brown trout out of the study areas and into the impoundment (North Pond) at the mouth of the creek.

This movement takes place some time after the fish spawn in the fall. Movement back into the creek occurs in early summer. It appears that this migration is done mainly by the brown trout, as the brook trout population remains relatively stable throughout the year.

There also seems to be some movement of browns toward the upper station prior to spawning. The adult brown-brook ratio in the upper station during the spring and summer estimates is about 2:1, whereas in the fall it changes to 3:1. There are also some large browns present in the upper station in the fall that are not there any other time of the year. This would seem logical, as the spawning substrate in the upper reaches of the Sidney is gravel, which browns prefer, while the limited spawning areas of the lower reaches have a predominately sand substrate which brooks, but not browns, will utilize. The difference in spawning substrate present at the two stations may also be the reason for the difference in species composition between these two portions of stream. In the upper station, brown trout far outnumber the brooks; however, there were only slightly more browns than brooks in the lower station. Again, the fine gravel and sand present in the lower station are preferred by the brook trout for spawning, whereas brown trout prefer the coarse gravels in the upper portion of the stream.



UPPER SIDNEY

SIZE RANGE IN INCHES

WINNBER OF TROUT PER ACRE

Figure 6. Length frequency of trout taken from the estimate stations on Sidney Creek, June 28, 1972.

Figure 7. Number of fingerling trout present in the Sidney Creek stations during the fall estimates.

Table 6. Growth rates of trout in Sidney Creek (sample size in parentheses).

	1969	Total	Length	3	by Year Class	lass 1	Average	18 C
Age Group	Brown	Brook	Brown	Brook	Brown	Brook	Brown	Brook
		ÞΪ	Upper Station	ion				
0 Fall	3.0(232)	2.9(92)	2.9(92) 3.3(300) 3.1(88)		3.2(393)	3.3(87)	3.2	3.1
Spring Summer Fall	3.3(116) 4.4(74) 5.4(81)	3.2(44) 4.3(27) 5.0(18)	4.4(142) 5.0(83) 5.9(72)	4.4(42) 5.0(20) 5.7(17)	3.9(72) 4.9(27)	3.8(11) 5.2(2)	6.4 8.	3.8 8
II Spring Summer Fall	5.7(5) 7.0(3) 7.7(3)	6.7(1) 8.0(2)		6.5(3) 7.0(1)			5.7 7.0 7.7	6.5 6.9 8.0
III Spring Summer		9.0(1)						0*6
			Lower St	Station				
0 Fall	3.3(94)	3.2(88)	3.6(135)	3.5(50)	3.7(71)	3.7(135)	3.5	3.5
I Spring Summer Fall	3.9(79) 4.8(68) 6.3(52)	3.8(66) 4.8(62) 5.5(24)	4.6(10) 6.1(9) 7.0(12)	4.6(2) 5.8(8) 7.8(8)	4.4(19) 5.9(5)	4.7(14) 6.0(3)	6.7 6.7	4.4 5.5 6.7
II Spring Summer Fall	7.9(3)	7.1(13)		6.8(2)			7.9	7.0
III Spring Summer	11.3(1)					and the second s		11.3

Another factor which indicates that movement occurs in the trout populations of the Sidney is the large number of unmarked trout captured at each station even though each year class was clipped for three successive years. Fingerling trout were clipped each fall and again the following spring. This means that we should have had the majority of the year class marked, as our efficiencies were running between 30 and 50% on fish of this size. However, only a small percentage of the fish caught were marked. This made it impossible to make any estimates of overwinter survival and is the reason for our rather sketchy growth data.

It is hard to estimate how much of this movement would have occurred had it not been for the pond situated at the mouth of the creek. However, it is important to be aware of the amount of movement that can occur. A routine survey of this stream conducted in the spring of the year would yield a completely different picture than a survey conducted in the summer or early fall. It is very important that survey stations are long enough so that you can minimize the effect of movement into or out of them. In this study, our stations were 850 feet and 1,950 feet in length and we had a considerable amount of migration from each. Again, the pond situated at the stream's mouth probably accounted for some of this.

Growth of trout in Sidney Creek was somewhat slower than in central or southern Wisconsin trout streams. This is to be expected because of the shorter growing season and the small amount of overwinter growth. There was also a difference in growth between the upper and lower stations in the Sidney. The fish in the upper station were slower growing than those in the lower reaches. This has been seen in many of the streams we have sampled in northeastern Wisconsin. Some factors that could account for this are slightly colder water and denser trout populations in the upper reaches.

Based on averages of our summer estimates, 35% of the brown trout and 27% of the brook trout in the Sidney had attained the legal size of 6 inches by the beginning of July. Only 15% of the browns and 9% of the brooks were over 8 inches at that time. This is true even for a stream considered to have very light fishing pressure. Based on this information, any increase in the size limit for brook or brown trout would be inappropriate for streams like the Sidney. Actually, if anglers would keep trout smaller than 6 inches, the present size limit could be removed without any deleterious effect on the trout population, assuming that the fishing pressure did not increase to any great extent.

CONCLUSIONS

- 1. Average standing crop of trout in Sidney Creek was 46 lbs/acre. This changed dramatically depending on the season and the area of the stream sampled.
- 2. There was a great deal of movement of trout into and out of the survey stations. This could be the result of spawning movements and the overwintering of trout in the pond located at the creek's mouth.

- 3. There were more trout in the upper reaches of the stream than in the lower portion. However, the trout in the upper reaches were slower growing than those in the lower portion.
- 4. Brown trout greatly outnumbered brooks in the upper portion of the Sidney presumably because of better spawning substrate for browns in this area. The number of brook trout about equaled the number of browns in the lower reaches where spawning substrates seemed to favor the brooks.
- 5. Growth of trout in Sidney Creek was slower than for trout in the southern part of the state or in larger streams. Any increase in the size limit of either brook or brown trout would be inappropriate as very few trout would ever attain the length of a higher size limit.

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Edited by Betty Les